DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF-1211
ENGLUND AND TEAFORD-COAL RESOURCES,
JEWELL RIDGE QUAD., VA.

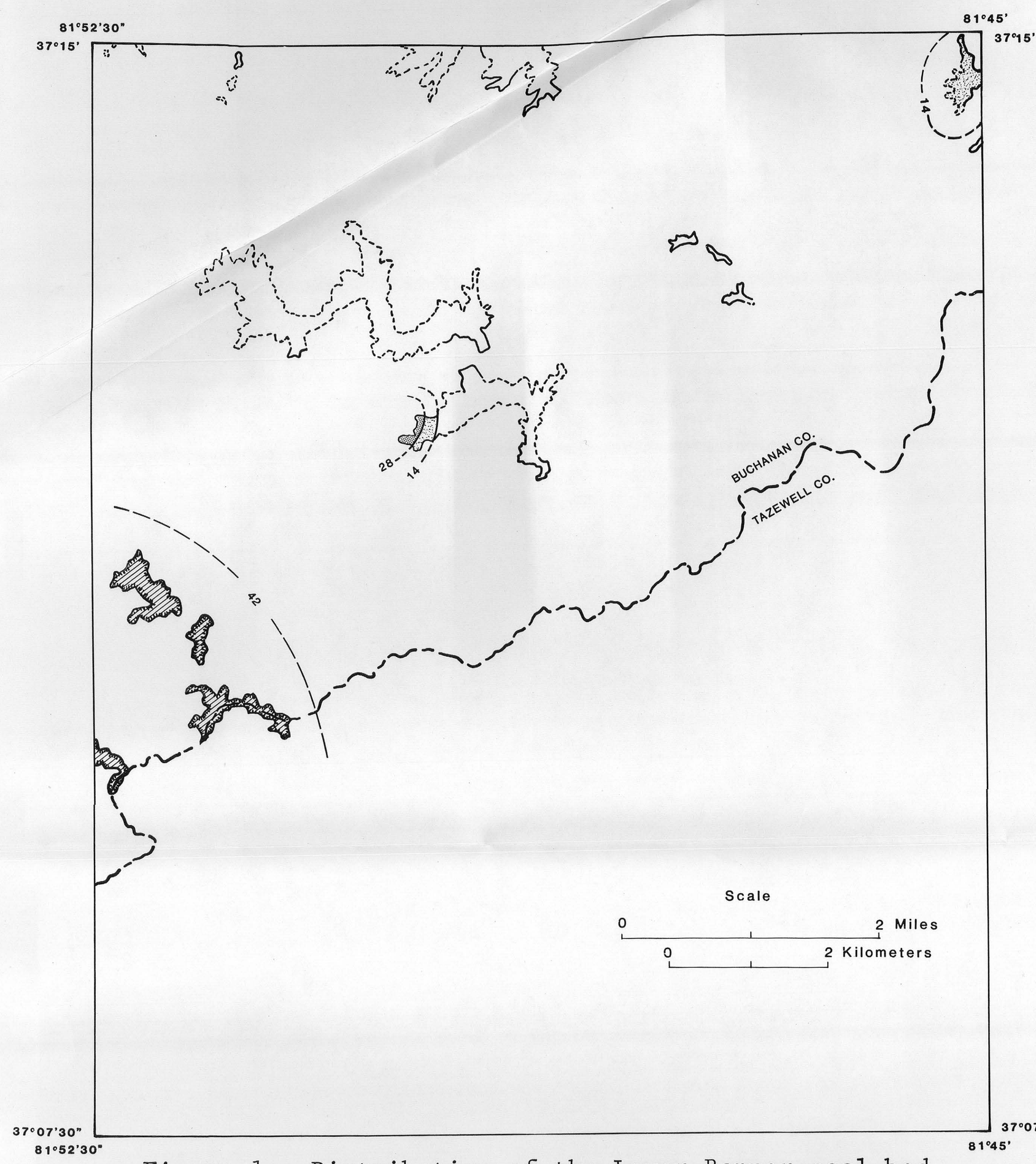


Figure 1.--Distribution of the Lower Banner coal bed.

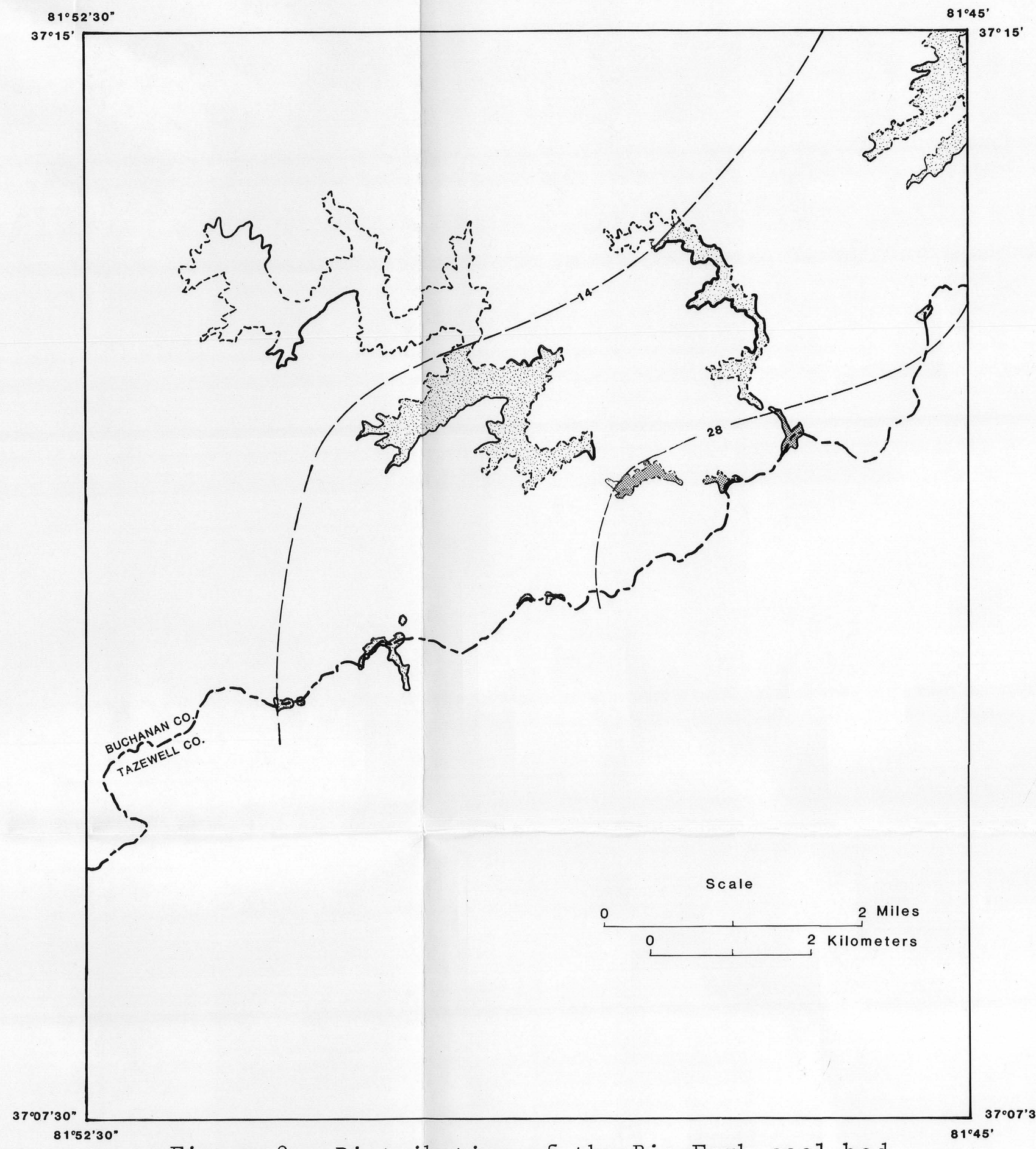


Figure 2.--Distribution of the Big Fork coal bed.

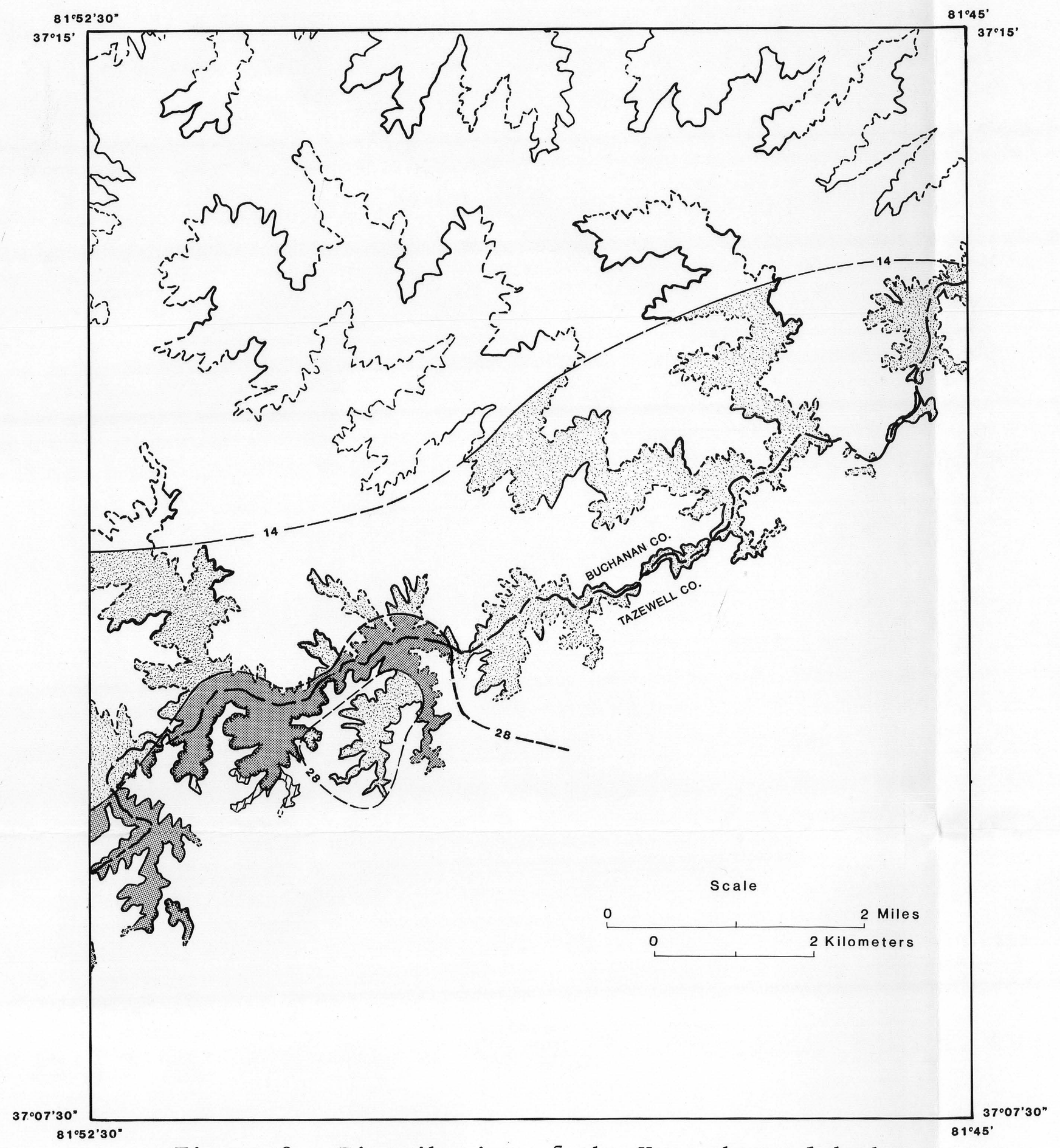


Figure 3.--Distribution of the Kennedy coal bed.

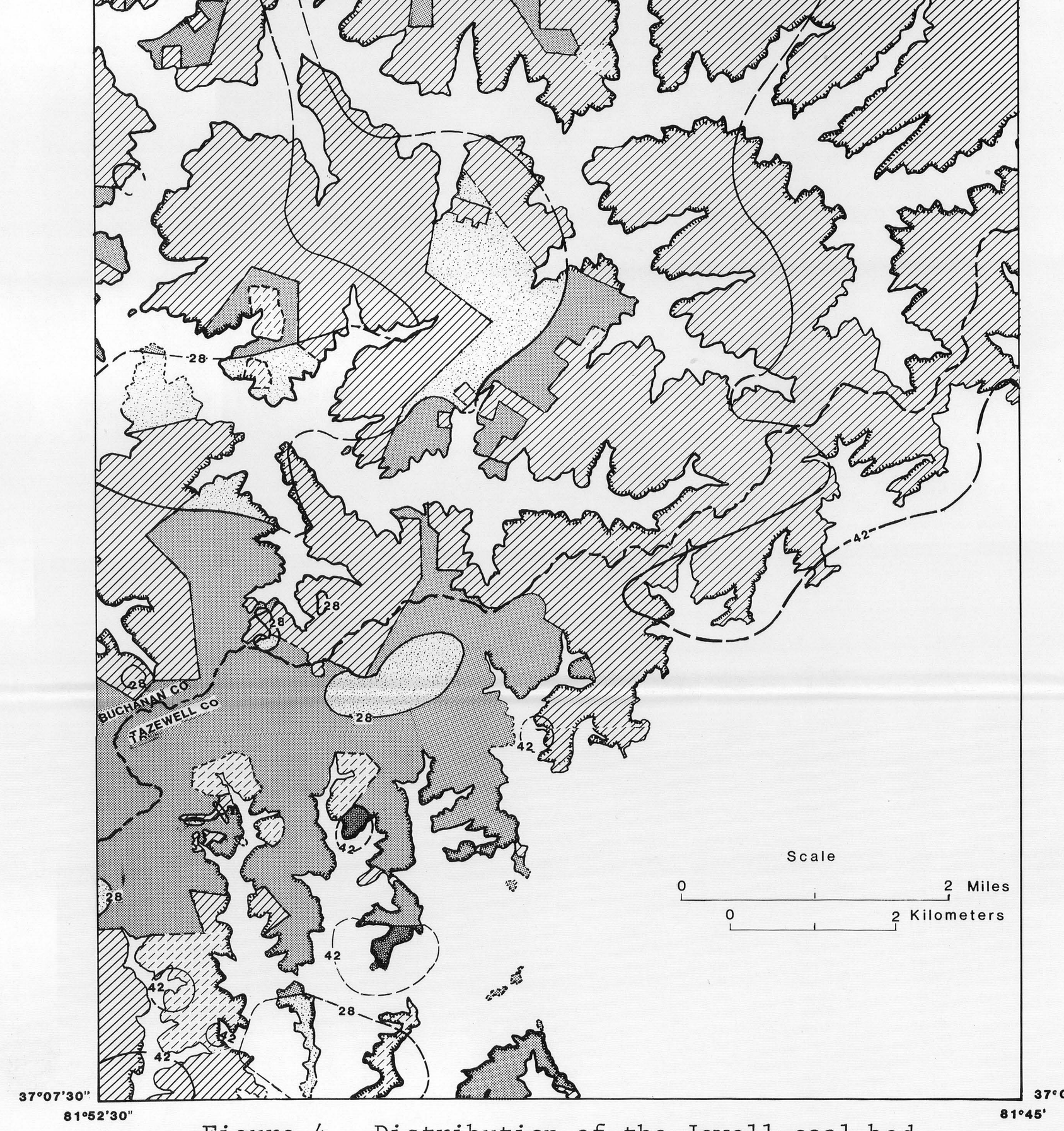


Figure 4.--Distribution of the Jewell coal bed.

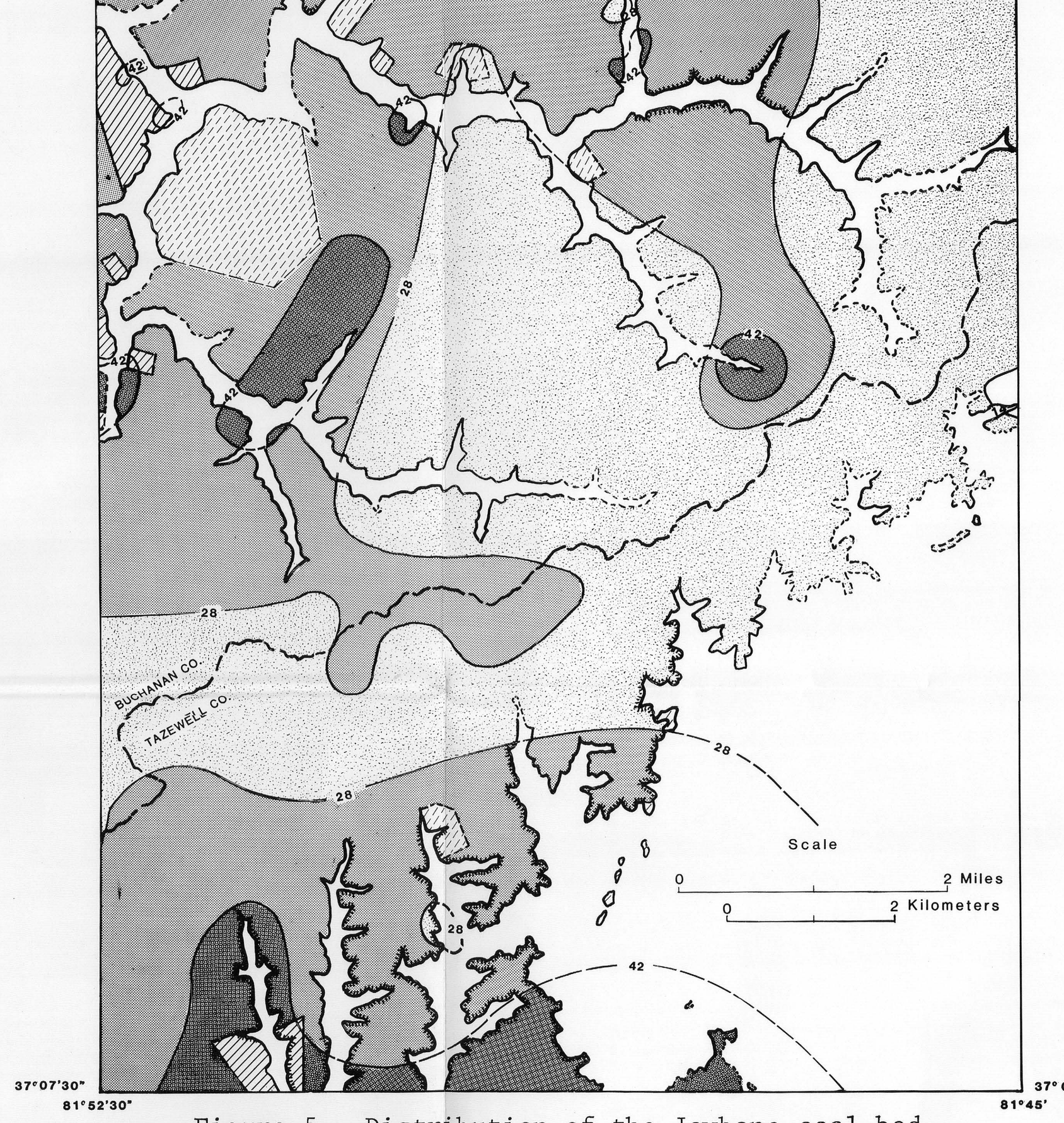


Figure 5.--Distribution of the Jawbone coal bed.

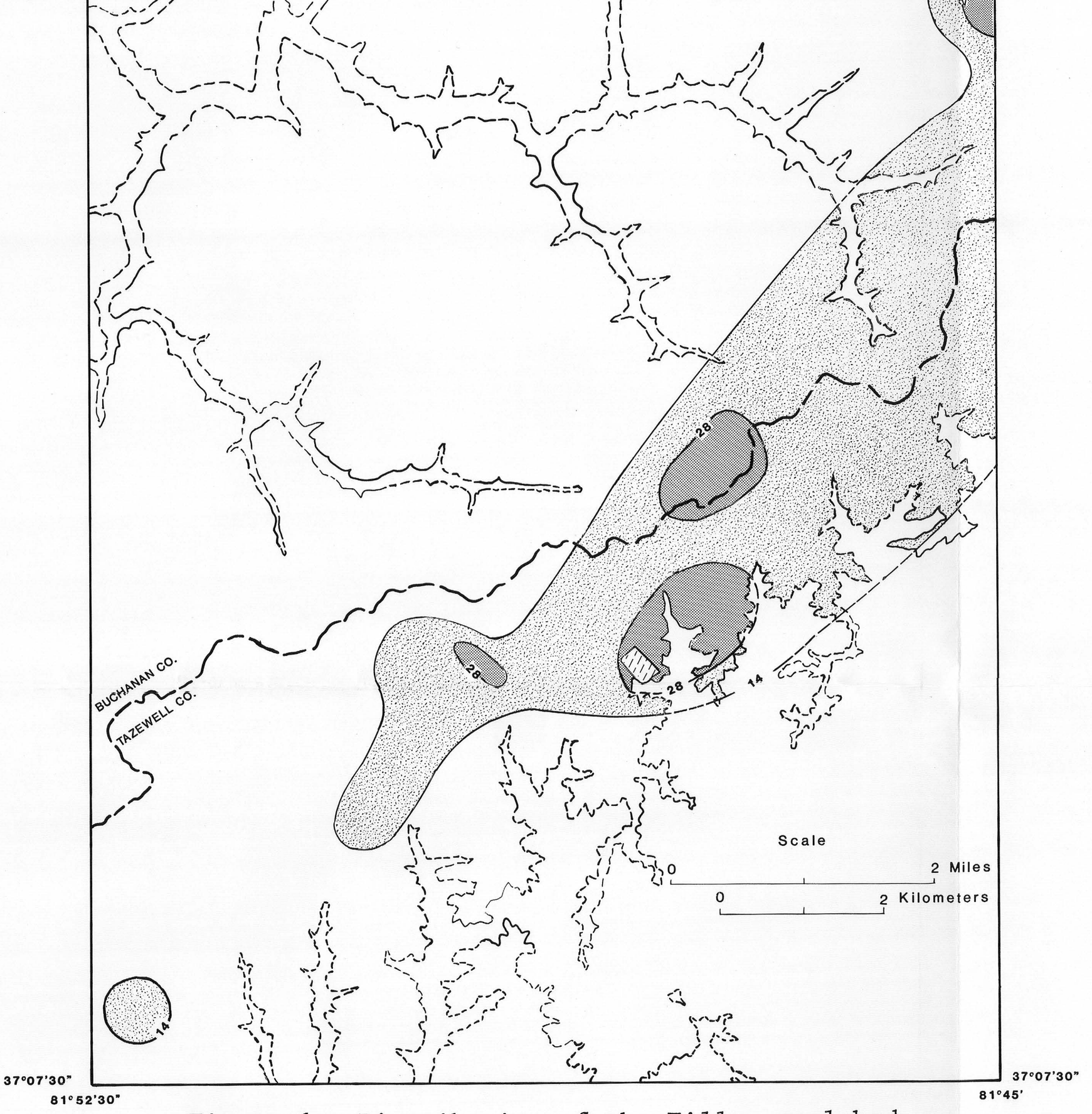


Figure 6.--Distribution of the Tiller coal bed.

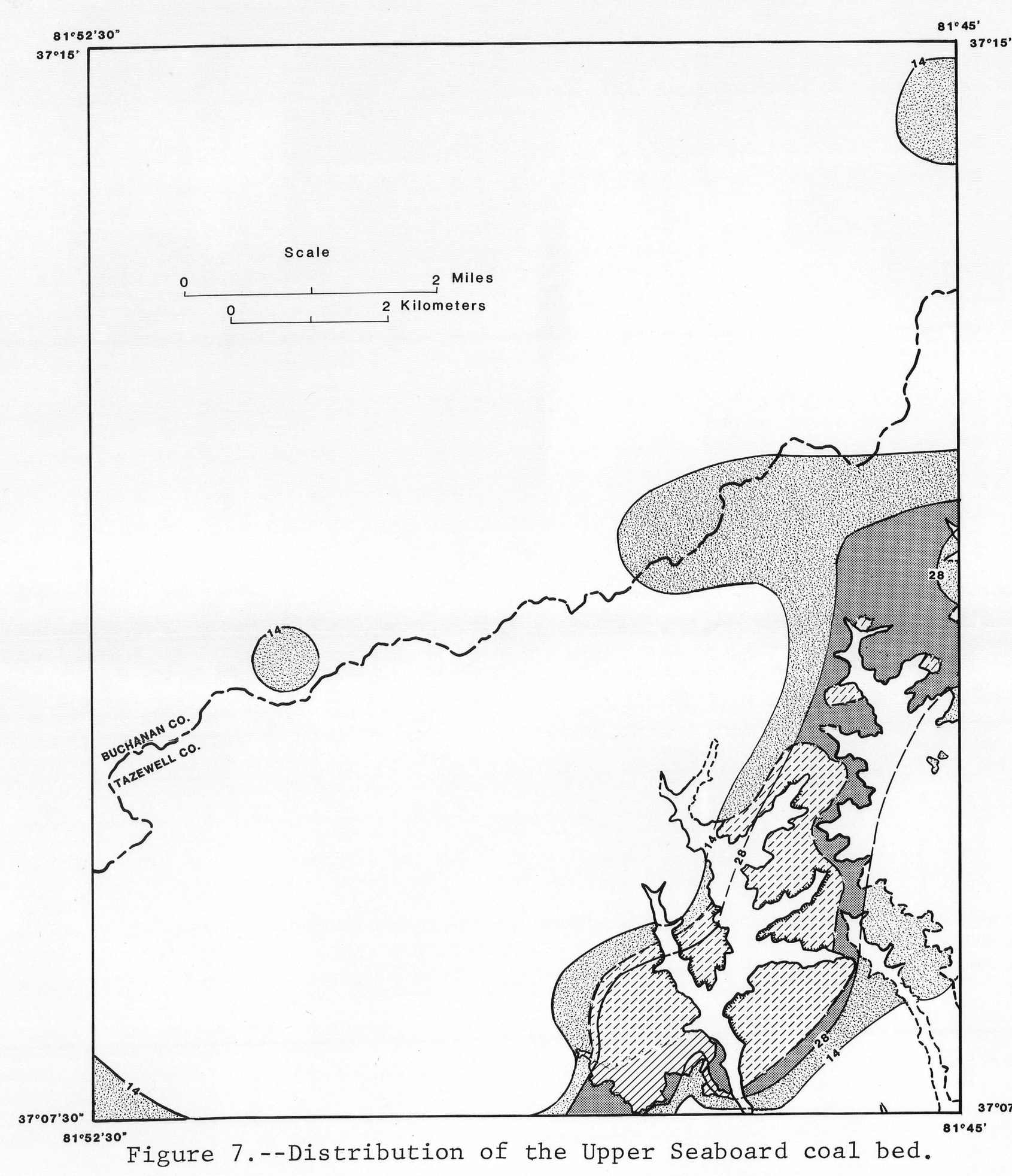


Figure 7.--Distribution of the Upper Seaboard coal bed.

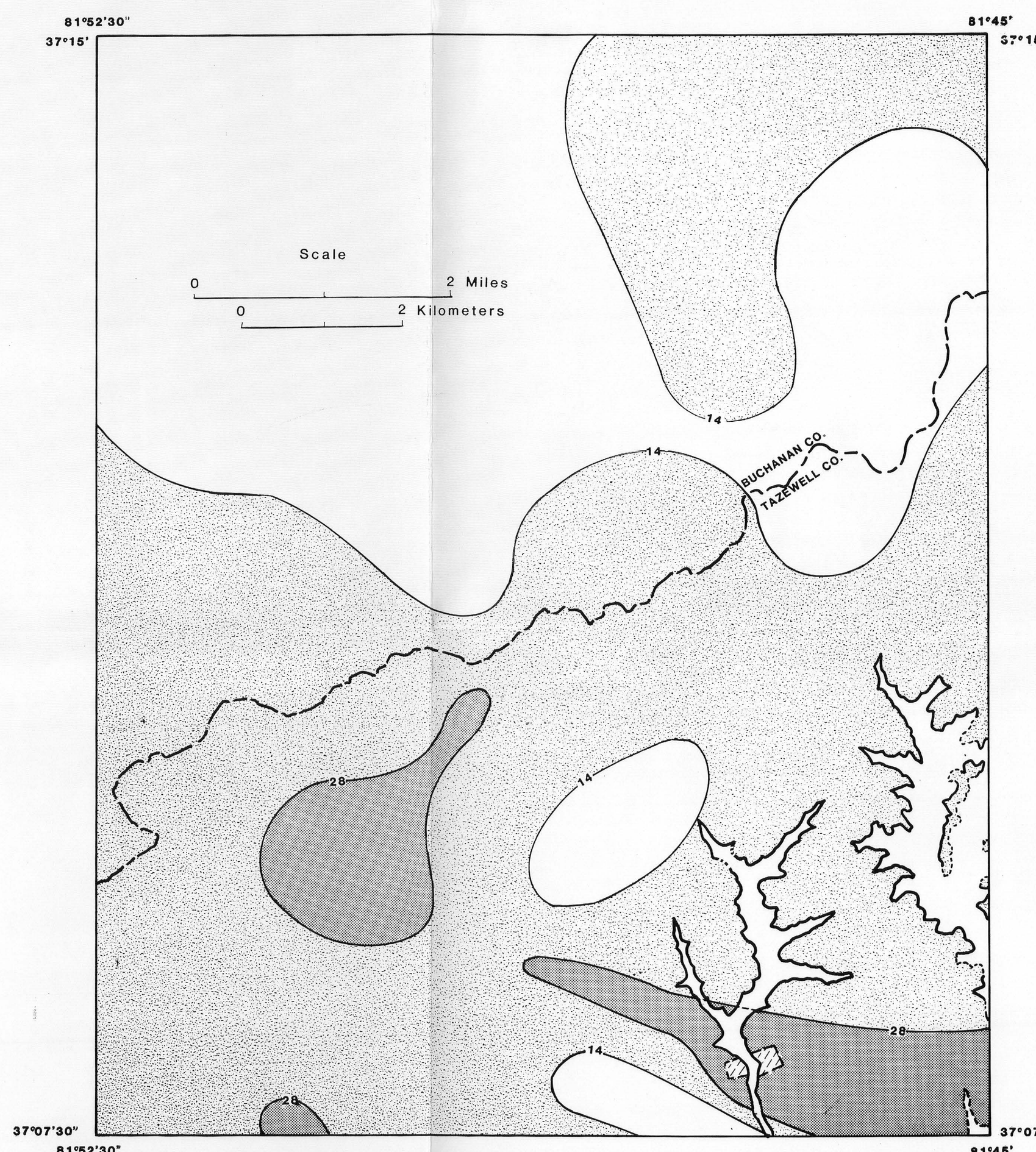


Figure 8.--Distribution of the Middle Seaboard coal bed.

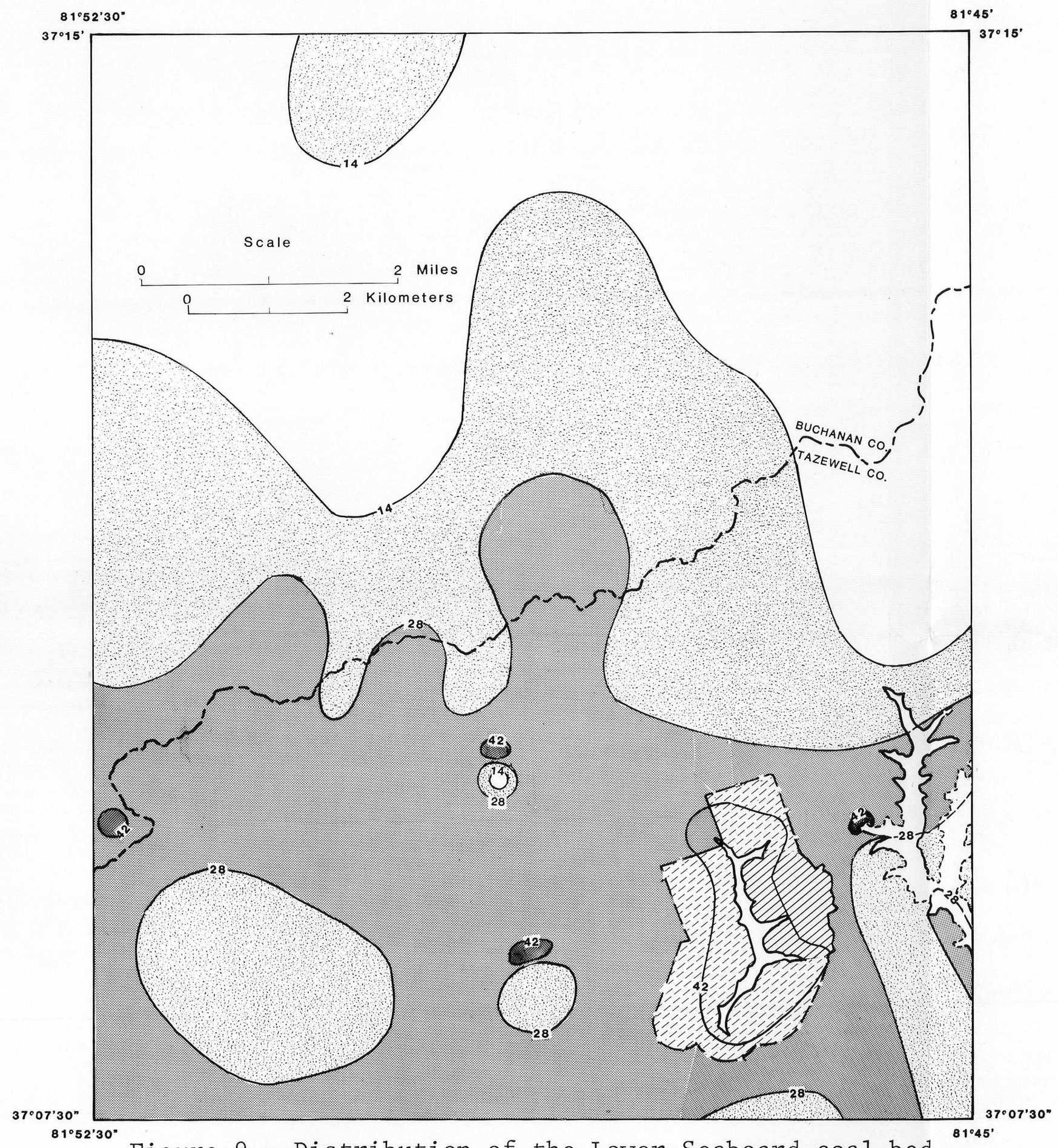


Figure 9.--Distribution of the Lower Seaboard coal bed.

MAPS SHOWING COAL RESOURCES OF THE JEWELL RIDGE QUADRANGLE, BUCHANAN AND TAZEWELL COUNTIES, VIRGINIA

By
Kenneth J. Englund and Nancy K. Teaford
1980

EXPLANATION

- Area underlain by estimated coal resources greater than 42 in. (105 cm) thick
- Area underlain by estimated coal resources 28-42 in. (70-105 cm) thick
- Area underlain by estimated coal resources 14-28 in. (35-70 cm) thick
- Area where coal is absent or less than 14 in. (35 cm) thick
- Mined area--Dashed where approximately outlined
- Outcrop of coal bed--Dashed where approximately located
- 14 — Coal thickness line--Dashed where approximately located. Thickness is in inches; isopach interval is 14 in.
- Outline of strip mine

Coal Geology

Coal of low-volatile to high-volatile A bituminous rank is the principal developed mineral resource in the Jewell Ridge quadrangle. The coal beds in the Jewell Ridge quadrangle contain total estimated original resources of 1,519 million tons. Of this total, 108 million tons have been mined or lost in mining, leaving 1,411 million tons of remaining resources. Table 1 lists coal resource estimates for all coal beds in the quadrangle.

Production has come mostly from several underground mines in the Jewell coal bed and, to a lesser extent, from underground mines in the Lower, Middle, and Upper Seaboard, Tiller, Jawbone, Kennedy, and Lower and Upper Banner coal beds. Strip and auger mining have depleted the coal in extensive but narrow belts that parallel the outcrop of these coal beds. Figures 1-9 show the distribution of coal in the principal beds that crop out in the quadrangle.

Coal-bearing rocks in the Jewell Ridge quadrangle total about 3,100 feet (945 m) in thickness and are assigned to the Pocahontas, New River, and Kanawha Formations of Early to Middle Pennsylvanian age. The stratigraphic distribution and thickness of coal beds in each of these formations are indicated in figure 10 together with the lithology and thickness of intervening strata. Nearly all of the coal is banded and consists of bright attritus and vitrain with minor amounts of dull attritus. Partings of shale, underclay, impure coal, and fusain are present locally. Finely disseminated pyrite occurs sparingly in some beds.

Analyses of 21 samples of coal show that the coal is mostly of high quality and suitable for the manufacture of coke. On an as-received basis, most of the coal is low in ash (less than 9 percent), low in sulfur (less than 1 percent), and high in heating values (greater than 14,000 Btu/pound) (table 4). Trace element and major and minor oxide compositions of both laboratory coal ash and whole coal are listed in tables 2 and 3. None of the samples contained significant amounts of potentially toxic or economically valuable trace elements.

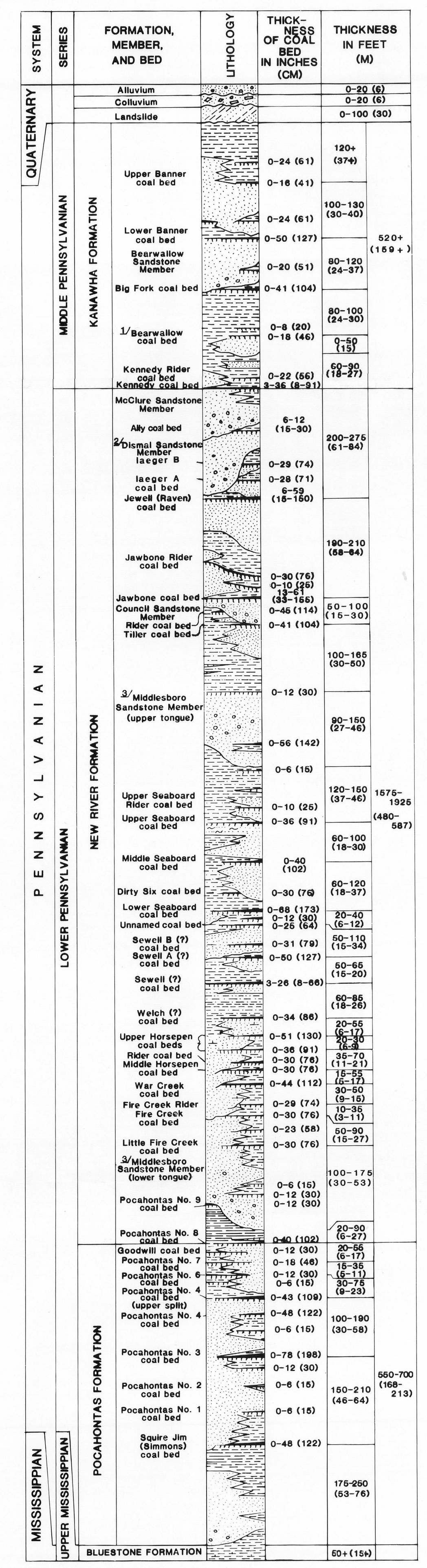


Figure 10.--Generalized stratigraphic column of coal-bearing formations.

[1]In this quadrangle, Bearwallow Conglomerate reduced in rank to Bearwallow Sandtone Member and assigned to Kanawha Formation. Bearwallow Conglomerate remains good usage elsewhere in Virginia and in West Virginia.

[2]Dismal Formation and its Dismal Conglomerate Lentil of Campbell (1897) adopted by U.S. Geological Survey usage as Dismal Sandstone Member of New River Formation, one of four members.

[3]In this quadrangle, Middlesboro Member of Lee Formation reassigned to: New River Formation as Middlesboro Sandstone Member (lower and upper tongues). Middlesboro Member remains member of Lee to west in Virginia and in southeastern Kentucky.

Campbell, M. R., 1897, Description of the Tazewell quadrangle [Virginia-West Virginia]: U.S. Geological Survey Geologic Atlas, Tazewell Folio 44, 6 p.

Table 1.--Estimated original and remaining coal resources in the Jewell Ridge quadrangle, in thousands of short tons, as of January, 1979

FORMATION	COAL BED	ORIGINAL RESOURCES																Mined and lost in Mining	Total Remaining Resources
		MEASURED				INDICATED				INFERRED				TOTAL					
		In beds 14-28 inches thick	In beds 28-42 inches thick	In beds more than 42 inches thick	Total	In beds 14-28 inches thick	In beds 28-42 inches thick	In beds more than 42 inches thick	Total	In beds 14-28 inches thick	In beds 28-42 inches thick	In beds more than 42 inches thick	Total	In beds 14-28 inches thick	In beds 28-42 inches thick	In beds more than 42 inches thick	Total		
	BUCHANAN COUNTY (covered by less than 1,000 feet of overburden)																		
Kanawha	Upper Banner	2	-	-	2	-	-	-	-	-	-	-	-	2	-	-	2	-	2
	Lower Banner	148	61	1,167	1,376	-	-	-	-	-	-	-	-	148	61	1,167	1,376	1,167	209
	Big Fork	1,091	197	-	1,288	1,608	-	-	1,608	102	-	-	102	2,801	197	-	2,998	2	2,996
	Kennedy	1,781	783	-	2,564	4,683	358	-	5,041	260	-	-	260	6,724	1,141	-	7,865	-	7,865
New River	Jewell	9,963	44,041	18,448	72,452	295	402	-	697	-	-	-	-	10,258	44,443	18,448	73,149	60,249	12,900
	Jawbone Rider	4,190	28	-	4,218	22,133	-	-	22,133	5,104	-	-	5,104	31,427	28	-	31,455	-	31,455
	Jawbone	5,581	20,740	3,626	29,947	19,309	21,825	2,177	43,311	3,186	1,634	-	4,820	28,076	44,199	5,803	78,078	7,248	70,830
	Tiller Rider	1,324	456	-	1,780	3,934	463	-	4,397	678	-	-	678	5,936	919	-	6,855	-	6,855
	Tiller	1,283	657	-	1,940	3,980	412	-	4,392	229	-	-	229	5,492	1,069	-	6,561	-	6,561
	Upper Seaboard	722	-	-	722	522	-	-	522	-	-	-	-	1,244	-	-	1,244	-	1,244
	Middle Seaboard	2,527	-	-	2,527	8,440	-	-	8,440	2,234	-	-	2,234	13,201	-	-	13,201	-	13,201
	Lower Seaboard	3,478	1,106	-	4,584	9,892	2,640	-	12,532	1,345	-	-	1,345	14,715	3,746	-	18,461	-	18,461
	Unnamed	996	-	-	996	3,147	-	-	3,147	2,240	-	-	2,240	6,383	-	-	6,383	-	6,383
	Sewell A(?)	2,284	713	-	2,997	7,456	272	-	7,728	2,365	-	-	2,365	12,105	985	-	13,090	-	13,090
	Sewell(?)	2,718	-	-	2,718	9,408	-	-	9,408	2,228	-	-	2,228	14,354	-	-	14,354	-	14,354
	Welch(?)	322	14	-	336	513	-	-	513	113	-	-	113	948	14	-	962	-	962
	Upper Horsepen (upper split)	970	2,265	-	3,235	3,822	4,461	-	8,283	1,830	240	-	2,070	6,622	6,966	-	13,588	-	13,588
	Upper Horsepen (lower split)	314	-	-	314	260	-	-	260	-	-	-	-	574	-	-	574	-	574
	Middle Horsepen Rider	-	-	-	-	77	-	-	77	2	-	-	2	79	-	-	79	-	79
	Middle Horsepen	742	-	-	742	971	-	-	971	401	-	-	401	2,114	-	-	2,114	-	2,114
	War Creek	222	-	-	222	183	-	-	183	-	-	-	-	405	-	-	405	-	405
	Fire Creek Rider	197	-	-	197	335	-	-	335	51	-	-	51	583	-	-	583	-	583
	Fire Creek	166	197	-	363	1,168	47	-	1,215	455	-	-	455	1,789	244	-	2,033	-	2,033
	TOTALS	41,021	71,258	23,241	135,520	102,136	30,880	2,177	135,193	22,823	1,874	-	24,697	165,980	104,012	25,418	295,410	68,666	226,744
	BUCHANAN COUNTY (covered by more than 1,000 feet of overburden)																		
New River	Upper Seaboard	207	-	-	207	362	-	-	362	-	-	-	-	569	-	-	569	-	569
	Middle Seaboard	1,083	-	-	1,083	5,796	-	-	5,796	1,685	-	-	1,685	8,564	-	-	8,564	-	8,564
	Lower Seaboard	393	1,227	169	1,789	5,315	3,001	-	8,316	1,905	-	-	1,905	7,613	4,228	169	12,010	-	12,010
	Unnamed	685	-	-	685	4,225	-	-	4,225	2,015	-	-	2,015	6,925	-	-	6,925	-	6,925
	Sewell B(?)	352	-	-	352	107	-	-	107	-	-	-	-	459	-	-	459	-	459
	Sewell A(?)	1,658	262	475	2,395	11,994	657	88	12,739	-	-	-	-	13,652	919	563	15,134	-	15,134
	Sewell(?)	2,347	-	-	2,347	15,811	-	-	15,811	4,693	-	-	4,693	22,851	-	-	22,851	-	22,851
	Welch(?)	600	601	-	1,201	1,981	-	-	1,981	274	-	-	274	2,855	601	-	3,456	-	3,456
	Upper Horsepen (upper split)	1,889	2,993	-	4,882	10,922	17,895	-	28,817	4,706	4,190	-	8,896	17,517	25,078	-	42,595	-	42,595
	Upper Horsepen	348	-	-	348	2,020	-	-	2,020	441	-	-	441	2,809	-	-	2,809	-	2,809
	Middle Horsepen Rider	144	-	-	144	381	-	-	381	38	-	-	38	563	-	-	563	-	563
	Middle Horsepen	1,317	-	-	1,317	4,566	-	-	4,566	2,112	-	-	2,112	7,995	-	-	7,995	-	7,995
	War Creek	69	-	-	69	255	-	-	255	-	-	-	-	324	-	-	324	-	324
	Fire Creek Rider	1,041	218	-	1,259	3,551	-	-	3,551	281	-	-	281	4,873	218	-	5,091	-	5,091
	Fire Creek	1,583	477	-	2,060	11,326	155	-	11,481	4,699	-	-	4,699	17,608	632	-	18,240	-	18,240
Pocahontas	Pocahontas No. 4 (upper split)	1,047	-	-	1,047	5,044	-	-	5,044	6,016	-	-	6,016	12,107	-	-	12,107	-	12,107
	Pocahontas No. 4	2,379	1,150	-	3,529	10,480	9,461	-	19,941	1,581	7,664	-	9,245	14,440	18,275	-	32,715	-	32,715
	Pocahontas No. 3	733	1,359	18,719	20,811	4,297	11,517	95,404	111,218	1,987	6,286	27,072	35,345	7,017	19,162	141,195	167,374	-	167,374
	Squire Jim	254	-	-	254	832	40	-	872	9,235	292	-	9,527	10,321	332	-	10,653	-	10,653
	TOTALS	18,129	8,287	19,363	45,779	99,265	42,726	95,492	237,483	41,668	18,432	27,072	87,172	159,062	69,445	141,927	370,434	-	370,434
	Buchanan County TOTALS	59,150	79,545	42,604	181,299	201,401	73,606	97,669	372,676	64,491	20,306	27,072	111,869	325,042	173,457	167,345	665,844	68,666	597,178
	TAZEWELL COUNTY (covered by less than 1,000 feet of overburden)																		
Kanawha	Lower Banner	-	-	198	198	-	-	-	-	-	-	-	-	-	-	198	198	198	-
	Big Fork	8	26	-	34	18	-	-	18	51	-	-	51	77	26	-	103	2	101
	Kennedy	1,516	2,992	-	4,508	892	487	-	1,379	36	-	-	36	2,444	3,479	-	5,923	407	5,516
New River	Jewell	1,188	24,653	8,866	34,707	387	1,161	-	1,548	-	-	-	-	1,575	25,814	8,866	36,255	18,940	17,315
	Jawbone Rider	4,101	-	-	4,101	11,208	-	-	11,208	2,133	-	-	2,133	17,442	-	-	17,442	-	17,442
	Jawbone	4,215	10,500	9,170	23,885	10,646	10,235	1,010	21,891	121	170	-	291	14,982	20,905	10,180	46,067	3,967	42,100
	Tiller Rider	1,490	1,842	120	3,452	2,763	2,570	-	5,333	839	-	-	839	5,092	4,412	120	9,624	-	9,624
	Tiller	3,176	1,644	-	4,820	8,184	611	-	8,795	551	-	-	551	11,911	2,255	-	14,166	126	14,040
	Upper Seaboard	3,180	11,400	-	14,580	4,292	1,407	-	5,699	6	-	-	6	7,478	12,807	-	20,285	7,630	12,655
	Middle Seaboard	6,962	3,701	-	10,663	26,219	8,940	-	35,159	1,832	35	-	1,867	35,013	12,676	-	47,689	215	47,474
	Dirty Six	723	283	-	1,006	1,986	143	-	2,129	20	-	-	20	2,729	426	-	3,155	-	3,155
	Lower Seaboard	3,551	15,220	5,454	24,225	10,430	22,714	-	33,144	388	236	-	624	14,369	38,170	5,454	57,993	8,259	49,734
	Unnamed	2,233	-	-	2,233	5,626	-	-	5,626	68	-	-	68	7,927	-	-	7,927	-	7,927
	Sewell B(?)	1,533	415	-	1,948	6,938	-	-	6,938	1,198	-	-	1,198	9,669	415	-	10,084	-	10,084
	Sewell A(?)	3,236	2,392	-	5,628	18,791	2,070	-	20,861	815	-	-	815	22,842	4,462	-	27,304	-	27,304
	Sewell (?)	7,524	-	-	7,524	26,775	-	-	26,775	1,525	-	-	1,525	35,824	-	-	35,824	-	35,824
	Welch (?)	4,952	828	-	5,780	20,141	-	-	20,141	896	-	-	896	25,989	828	-	26,817	-	26,817
	Upper Horsepen (upper split)	1,359	7,579	104	9,042	3,875	31,397	-	35,272	70	6,404	-	6,474	5,304	45,380	104	50,788	-	50,788
	Upper Horsepen	1,891	-	-	1,891	6,909	16	-	6,925	1,339	-	-	1,339	10,139	16	-	10,155	-	10,155
	Middle Horsepen Rider	1,945	472	-	2,417	6,976	605	-	7,581	1,189	-	-	1,189	10,110	1,077	-	11,187	-	11,187
	Middle Horsepen	3,454	664	-	4,118	15,099	1,144	-	16,243	2,746	-	-	2,746	21,299	1,808	-	23,107	-	23,107
	War Creek	1,407	539	122	2,068	5,794	1,215	-	7,009	580	-	-	580	7,781	1,754	122	9,657	-	9,657
	Fire Creek Rider	735	24	-	759	1,236	-	-	1,236	45	-	-	45	2,016	24	-	2,040	-	2,040
	Fire Creek	1,866	275	-	2,141	8,463	404	-	8,867	2,195	-	-	2,195	12,524	679	-	13,203	-	13,203
	Little Fire Creek	523	11	-	534	2,219	-	-	2,219	511	-	-	511	3,253	11	-	3,264	-	3,264
Pocahontas	Pocahontas No. 4 (upper split)	610	229	-	839	1,256	392	15	1,663	56	-	-	56	1,922	621	15	2,558	-	2,558
	Pocahontas No. 4	168	-	-	168	257	-	-	257	-	-	-	-	425	-	-	425	-	425
	Pocahontas No. 3	-	-	-	-	26	-	-	26	-	-	-	-	26	-	-	26	-	26
	TOTALS	63,546	85,689	24,034	173,269	207,406	85,511	1,025	293,942	19,210	6,845	-	26,055	290,162	178,045	25,059	493,266	39,744	453,522
	TAZEWELL COUNTY (covered by more than 1,000 feet of overburden)																		
New River	Upper Seaboard	9	-	-	9	18	-	-	18	-	-	-	-	27	-	-	27	-	27
	Middle Seaboard	1,541	172	-	1,713	4,716	721	-	5,437	69	-	-	69	6,326	893	-	7,219	-	7,219
	Lower Seaboard	371	2,857	-	3,228	2,542	10,200	-	12,742	18	274	-	292	2,931	13,331	-	16,262	-	16,262
	Unnamed	225	-	-	225	1,772	-	-	1,772	19	-	-	19	2,016	-	-	2,016	-	2,016
	Sewell B(?)	237	224	-	461	2,057	-	-	2,057	23	-	-	23	2,317	224	-	2,541	-	2,541
	Sewell A(?)	1,111	1,068	-	2,179	6,180	3,690	-	9,870	106	-	-	106	7,397	4,758	-	12,155	-	12,155
	Sewell (?)	2,855	-	-	2,855	15,011	-	-	15,011	501	-	-	501	18,367	-	-	18,367	-	18,367
	Welch (?)	1,951	712	-	2,663	11,273	-	-	11,273	906	-	-	906	14,130	712	-	14,842	-	14,842
	Upper Horsepen (upper split)	1,551	4,431	166	6,148	13,147	12,644	-	25,791	623	774	-	1,397	15,321	17,849	166	33,336	-	33,336
	Upper Horsepen	1,045	186	-	1,231	6,801	412	-	7,213	594	-	-	594	8,440	598	-	9,038	-	9,038
	Middle Horsepen Rider	235	79	-	314	905	-	-	905	77	-	-	77	1,217	79	-	1,296	-	1,296
	Middle Horsepen	2,829	762	-	3,591	13,084	912	-	13,996	1,287	-	-	1,287	17,200	1,674	-	18,874	-	18,874
	War Creek	794	-	-	794	2,272	-	-	2,272	111	-	-	111	3,177	-	-	3,177	-	3,177
	Fire Creek Rider	2,970	-	-	2,970	7,911	-	-	7,911	229	-	-	229	11,110	-	-	11,110	-	11,110
	Fire Creek	3,485	747	-	4,232	15,039	90	-	15,129	929	-	-	929	19,453	837	-	20,290	-	20,290
	Little Fire Creek	444	266	-	710	2,872	-	-	2,872	356	-	-	356	3,672	266	-	3,938	-	3,938
Pocahontas	Pocahontas No. 4 (upper split)	2,473	2,200	416	5,089	10,853	9,368	2,400	22,621	1,468	2,208	-	3,676	14,794	13,776	2,816	31,386	-	31,386
	Pocahontas No. 4	1,129	1,688	120	2,937	7,147	5,503	-	12,650	453	617	-	1,070	8,729	7,808	120	16,657	-	16,657
	Pocahontas No. 3	1,731	3,769	10,084	15,584	7,005	22,973	32,711	62,689	1,726	1,633	1,092	4,451	10,462	28,375	43,887	82,724	-	82,724
	Squire Jim	1,072	1,835	542	3,449	9,063	10,834	1,349	21,246	24,689	5,463	200	30,352	34,824	18,132	2,091	55,047	-	55,047
	TOTALS	28,058	20,996	11,328	60,382	139,668	77,347	36,460	253,475	34,184	10,969	1,292	46,445	201,910	109,312	49,080	360,302	-	360,302
	Tazewell County TOTALS	91,604	106,685	35,362	233,651	347,074	162,858	37,485	547,417	53,394	17,814	1,292	72,500	492,072	287,357	74,139	853,568	39,744	813,824
	(Totals covered by more than 1,000 feet of overburden)																		
	Jewell Ridge quadrangle	104,567	156,947	47,275	308,789	309,542	116,391	3,202	429,135	42,033	8,719	-	50,752	456,142	282,057	50,477	788,676	108,410	680,266
	(Totals covered by less than 1,000 feet of overburden)																		
	TOTALS	46,187	29,283	30,691	106,161	238,933	120,073	131,952	490,958	75,852	29,401	28,364	133,617	360,972	178,757	191,007	730,736	-	730,736
	GRAND TOTAL	150,754	186,230	77,966	414,950	548,475	236,464	135,154	920,093	117,885	38,120	28,364	184,369	817,114	460,814	241,484	1,519,412	108,410	1,411,002

Table 2.--Trace element composition on a whole-coal basis
[Values in parts per million. L after a value means less than value shown. N means not detected. Analyses by U.S. Geological Survey.]

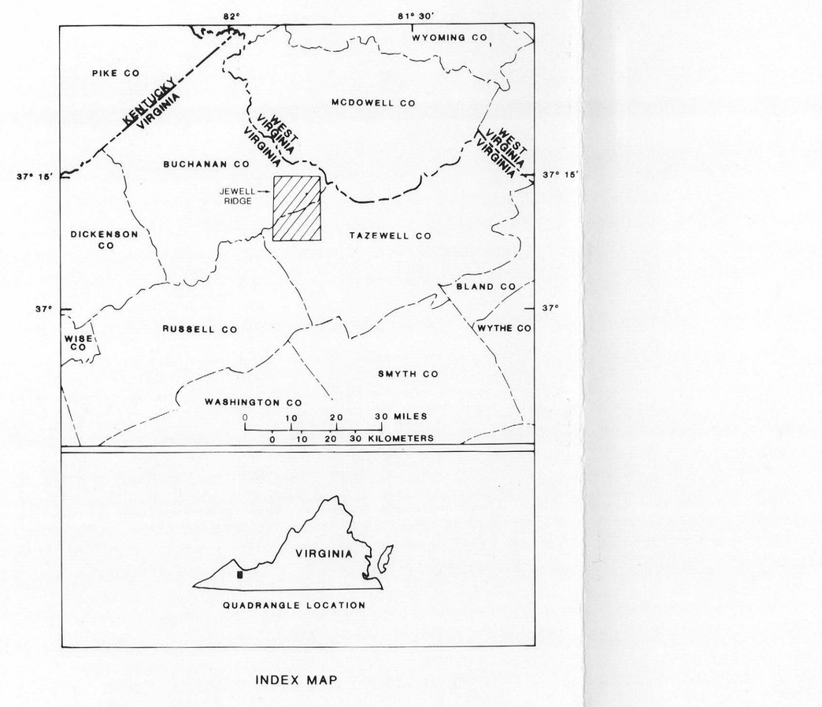
Trace Element	Kennedy d170129	Iaeger B d170166	Iaeger A d170165	Jewell d170131	Jewell d170140	Jewell d170146	Jewell d170148	Jewell d170159	Jewell d170164	Jawbone Rider d170130	Jawbone d170132	Jawbone d170156	Jawbone d170157	Jawbone d170158	Jawbone d170167	Tiller d170161	Lower Seaboard d170162	Lower Seaboard d170163
Ag	0.00	N	0.00	0.00	0.04	0.03	0.00	0.08	0.00	0.00	N	0.00	0.00	0.00	0.00	0.00	0.00	0.00
As	10.	90.	25.	5.	3.	10.	30.	8.00	5.	80.	20.	1.	8.	30.	10.	8.	8.	45.
B	2.	5.	2.	0.	1.	1.	2.	1.	3.	0.	3.	2.	5.	4.	2.	4.	2.	2.
Ba	102.	204.	395.	180.	117.	130.	156.	130.	207.	259.	87.	105.	138.	120.	160.	160.	238.	225.
Be	2.38	0.71	1.58	1.08	2.73	1.30	2.60	0.78	0.69	0.74	1.30	1.05	1.38	1.20	1.60	8.00	0.34	0.67
Cd	0.03	0.10L	0.08	0.04L	0.04L	0.03L	0.05L	0.03L	0.07L	0.04L	0.09L	0.10L	0.09L	0.12L	0.08L	0.08L	0.03L	0.04L
Ce	10.20	0.00	0.00	7.20	7.80	7.80	15.60	0.00	0.00	0.00	26.10	31.50	0.00	0.00	0.00	0.00	0.00	0.00
Co	5.10	2.04	7.90	3.60	7.80	3.90	5.20	2.60	4.83	1.85	4.35	5.25	4.60	6.00	5.60	5.60	1.02	2.25
Cr	5.10	10.20	11.85	5.40	5.85	2.60	7.80	2.60	10.35	3.70	13.05	15.75	13.80	18.00	12.00	12.00	6.80	4.50
Cu	17.00	11.63	23.70	12.24	11.39	9.05	12.27	9.36	19.73	7.03	18.10	23.73	18.77	25.20	16.64	13.92	6.12	11.61
F	20.L	30.	35.	20.	20.	20.L	20.L	20.L	20.L	20.L	145.	110.	45.	30.	135.	20.	35.	20.
Ga	1.70	3.06	2.37	1.08	1.95	0.78	2.60	0.78	2.07	1.11	4.35	5.25	4.60	6.00	4.00	5.60	0.68	1.35
Ge	0.68	0.00	N	1.80	2.73	1.82	3.64	0.78	N	0.74	1.74	0.00	N	0.00	2.40	0.00	N	0.00
Hg	0.07	0.19	0.55	0.06	0.05	0.05	0.13	0.05	0.05	0.42	0.10	0.05	0.08	0.20	0.06	0.07	0.08	0.22
La	5.10	N	11.85	5.40	3.90	3.90	7.80	2.60	6.90	3.70	17.40	21.00	9.20	12.00	12.00	8.00	2.38	3.15
Li	6.94	10.81	20.54	7.63	6.94	5.72	10.50	7.07	13.80	5.03	14.79	38.64	29.81	44.88	15.68	18.56	2.92	14.85
Mo	2.38	1.02	1.58	0.54	0.78	0.78	1.56	0.78	1.03	1.11	1.74	1.57	1.84	1.80	1.60	1.60	1.02	2.25
Nb	0.34	1.02	1.58	0.54	0.58	0.26	0.78	0.39	1.38	0.37	1.74	3.15	1.84	3.60	1.60	0.80	0.00	0.45
Nd	6.80	N	0.00	5.40	0.00	2.60	7.80	0.00	0.00	0.00	13.05	10.50	0.00	0.00	0.00	8.00	N	N
Ni	5.10	5.10	11.85	7.20	7.80	3.90	7.80	5.20	10.35	2.59	8.70	10.50	6.44	12.00	8.00	8.00	3.40	6.75
Pb	1.70	3.06	4.74	2.16	3.31	2.08	3.90	1.95	3.45	1.85	6.52	8.40	7.36	9.00	6.00	5.60	1.02	1.12
Sb	1.00	0.60	1.20	0.90	2.10	0.80	1.10	0.50	0.40	0.70	0.90	0.70	0.90	0.80	1.20	1.10	0.60	0.70
Sc	1.0	2.0	2.4	1.1	1.2	0.8	1.6	0.8	3.4	1.1	4.3	3.1	2.8	3.6	4.0	2.4	0.7	1.3
Se	0.4	2.2	4.6	1.5	0.2	0.8	1.6	1.5	2.6	0.7	0.5	2.5	1.7	3.6	1.9	2.9	1.5	1.7
Sn	N	N	N	N	N	N	N	N	N	N	N	N	N	1.20	N	N	N	N
Sr	170.00	204.00	395.00	180.00	117.00	182.00	156.00	130.00	207.00	259.00	87.00	157.50	138.00	84.00	160.00	240.00	238.00	225.00
U	0.63	0.99	1.17	0.54	0.60	0.45	0.55	0.35	1.34	0.37	1.61	2.15	1.59	2.08	1.49	1.48	0.29	0.69
V	10.20	15.30	23.70	7.20	7.80	5.20	10.40	3.90	20.70	7.40	17.40	15.75	18.40	24.00	16.00	40.00	5.10	9.00
Y	10.20	5.10	7.90	5.40	7.80	3.90	7.80	2.60	6.90	3.70	8.70	10.50	9.20	8.40	8.00	8.00	2.38	3.15
Yb	1.02	0.51	0.79	0.54	0.78	0.39	0.52	0.26	0.69	0.37	0.87	0.73	0.92	1.20	0.80	0.80	0.17	0.31
Zn	8.16	7.55	19.75	1.94	2.61	1.82	2.81	1.48	4.55	2.77	5.92	3.15	2.76	3.72	2.96	3.04	1.73	7.02
Zr	5.10	15.30	15.80	7.20	7.80	3.90	10.40	5.20	13.80	3.70	26.10	21.00	18.40	36.00	24.00	12.00	2.38	4.50

Table 3.--Major and minor oxide composition of the laboratory ash of coal samples
[Values in percent. L after a value means less than value shown. Analyses by U.S. Geological Survey.]

Coal bed Sample No.	Ash	SiO_2	Al_2O_3	CaO	MgO	Na_2O	K_2O	Fe_2O_3	MnO	TiO_2	P_2O_5	SO_3
Kennedy d170129	3.4	30.0	27.0	4.60	1.91	0.19	1.20	20.0	0.10	1.10	0.10L	6.80
Iaeger B d170166	10.2	40.0	23.0	2.30	1.13	0.24	2.10	21.0	0.02L	1.10	0.10L	2.80
Iaeger A d170165	7.9	48.0	24.0	2.50	0.95	0.16	1.20	14.0	0.05	1.50	0.18	4.10
Jewell d170131	3.6	33.0	22.0	4.00	2.41	0.24	0.70	23.0	0.11	1.10	0.10L	6.30
d170140	3.9	42.0	23.0	4.30	1.75	0.21	1.90	17.0	0.02L	1.30	0.10L	5.90
d170146	2.6	29.0	18.0	5.40	2.55	0.15	0.57	26.0	0.02L	1.10	0.10L	7.40
d170148	5.2	42.0	22.0	3.00	1.75	0.19	1.60	17.0	0.05	1.40	0.10L	2.60
d170159	2.6	31.0	26.0	3.40	2.85	0.67	0.79	24.0	0.02L	1.30	0.10L	4.80
d170164	6.9	50.0	27.0	2.30	1.20	0.53	1.00	8.9	0.02	1.70	0.10L	3.60
Jawbone Rider d170130	3.7	20.0	18.0	5.20	1.20	0.46	0.42	35.0	0.02L	0.76	0.10L	8.90
Jawbone d170132	8.7	50.0	32.0	2.80	2.05	1.22	1.20	8.6	0.14	1.50	2.00	1.40
d170156	10.5	52.0	30.0	1.90	0.55	0.13	0.86	3.9	0.02L	1.60	1.40	0.31
d170157	9.2	52.0	30.0	2.60	0.91	0.24	1.60	6.7	0.03	1.50	0.37	1.80
d170158	12.0	57.0	30.0	0.58	0.65	0.17	1.30	6.8	0.02L	2.00	0.16	0.62
d170167	8.0	51.0	27.0	4.40	0.90	0.20	0.88	7.6	0.02L	1.70	2.00	2.30
Tiller d170161	8.0	48.0	31.0	2.00	1.45	0.35	2.70	9.4	0.02L	0.87	0.10L	3.20
Lower Seaboard d170162	3.4	14.0	15.0	13.0	4.35	0.82	0.95	21.0	0.02L	0.54	0.50	15.00
d170163	4.5	27.0	21.0	7.40	2.75	0.28	2.40	20.0	0.02L	0.74	0.10	11.00

Table 4.--Proximate and ultimate analyses
[Analyses are on as-received basis. Channel samples by U.S. Geological Survey. Analyses by U.S. Bureau of Mines.]

Coal bed and sample No. (U.S.B.M. lab No.)	Proximate analysis (percent)				Ultimate analysis (percent)					Heating Value	Sulfur form (percent)		
	Moisture	Volatile matter	Fixed Carbon	Ash	Hydrogen	Carbon	Nitrogen	Oxygen	Sulfur	Btu/lb.	Sulfate	Pyritic	Organic
Kennedy d170129	2.6	30.2	64.0	3.2	5.3	83.0	1.5	6.1	0.9	14690	0.01	0.22	0.65
(K42797)	2.9	29.5	64.5	3.1	5.3	83.1	1.4	6.4	0.7	14710	0.01	0.36	0.35
Iaeger B d170166	3.2	27.2	60.6	9.0	4.8	76.4	1.1	6.1	2.6	13530	0.01	1.37	1.17
Iaeger A d170165	8.1	25.8	59.5	6.6	4.8	72.4	1.2	14.1	0.9	12500	0.01	0.16	0.77
Jewell (K42796)	3.1	26.1	68.1	2.7	5.2	84.1	1.3	6.2	0.5	14860	0.01	0.13	0.38
d170131	3.4	26.5	66.5	3.6	5.2	83.4	1.3	5.8	0.7	14630	0.03	0.34	0.31
d170140	3.6	28.7	63.9	3.8	5.2	81.8	1.3	7.4	0.5	14450	0.01	0.06	0.47
d170146	2.2	26.1	69.2	2.5	5.1	85.0	1.3	5.6	0.5	14920	0.01	0.06	0.42
d170148	2.0	26.6	67.3	4.1	5.0	83.8	1.3	5.1	0.7	14690	0.02	0.22	0.41
d170159	2.4	20.7	74.5	2.4	4.7	85.9	1.4	5.0	0.6	14940	0.01	0.05	0.53
d170164	2.9	26.8	64.8	5.5	5.1	81.2	1.4	5.9	0.9	14290	0.01	0.14	0.71
Jawbone Rider d170130	3.8	23.9	68.5	3.8	5.1	82.4	1.2	5.5	2.0	14430	0.16	1.26	0.56
Jawbone (K42795)	2.0	20.1	68.9	9.0	4.5	79.3	1.3	4.9	1.0	13860	0.02	0.47	0.54
d170132	2.0	19.4	70.0	8.6	4.5	80.3	1.4	4.5	0.7	13930	0.04	0.22	0.46
d170156	4.3	17.9	68.0	9.8	4.5	76.2	1.3	7.4	0.8	13160	0.01	0.03	0.76
d170157	3.1	19.5	69.1	8.3	4.6	79.2	1.4	5.9	0.6	13790	0.01	0.05	0.54
d170158	2.5	18.9	67.9	10.7	4.3	77.8	1.3	5.0	0.9	13520	0.01	0.29	0.56
d170167	2.3	23.4	67.1	7.2	4.7	80.6	1.4	5.4	0.7	14170	0.01	0.12	0.59
Tiller d170161	2.3	26.7	63.8	7.2	4.9	79.6	1.3	6.3	0.7	14000	0.04	0.05	0.56
Lower Seaboard d170162	2.0	26.6	68.2	3.2	5.1	83.6	1.6	5.6	0.9	14710	0.01	0.24	0.68
d170163	1.9	26.8	67.1	4.2	5.0	82.5	1.5	5.6	1.2	14560	0.10	0.42	0.73



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